UNIVERSITI TEKNOLOGI MARA

COMPARATIVE ANALYSIS OF OSPF AND MPLS UNICAST IP ROUTING ON FRAGMENTATION

SURAYA BINTI ZAINUDDIN

Thesis submitted in fulfillment
of the requirements for the degree of
Master of Science in Telecommunication and Information Engineering

Faculty of Electrical Engineering

January 2015

ABSTRACT

Multiprotocol Label Switching (MPLS) is a standard architecture proposed by the Internet Engineering Task Force (IETF) that integrates label swapping forwarding with network layer routing. It is a promising effort in order to deliver better network performance. MPLS is acknowledged and widely been used to overcome drawbacks introduce by traditional IP routing. This paper discussed on the network performance with the effect of packet fragmentation over IP and MPLS networks. In real implementation, fragmented IPv4 traffic causes a lot of problem such as increase load at router CPUs and also result in poor performance or even total communication failure. In addition, traffic fragmentation is used in numerous network attacks. Thus, we want to avoid the fragmentation at all or ensure the network is insulated from fragmented traffic. However, in some cases when using IPv4 fragmentation is unavoidable. Simulation models were developed using Graphical Network Simulator GNS3 to compare performance of Open Shortest Path First (OSPF) and MPLS network. Performance is determined by Round-Trip-Time (RTT), calculated throughput and packet loss. Analysis shows different protocols, data sizes and MTUs influence network performance. OSPF provides better RTT and throughput compared to MPLS with default MTU setting. However, better RTT and calculated throughput performance can be achieved by increasing the MTU for interface, IP and MPLS. Finally, the study also indicates packet fragmentation could degrades network performance in both network topologies.

ACKNOWLEDGEMENT

I would like to express my gratitude to Associate Professor Ruhani Ab Rahman, for her guidance throughout the project and thanks to all authors from whom I obtained all the information for this study through their writings, documentations and slide presentations.

I would also like to extend my thanks to my beloved husband, Mohd. Zahidi Lutfi bin Zainal Abidin for his continuous support, unconditional love and and prayers. Thanks to my daughter, Zayra Adelea; my both parents and parents in law and siblings for the understanding throughout my study.

Finally, the greatest thanks to all my classmate EE700 for the priceless support in making this thesis success.

TABLE OF CONTENTS

CHAPTER ONE
INTRODUCTION

1.1 BACKGROUND OF STUDY

The Internet depends on the forwarding of data through the network on a per packet basis. In order to provide the service, routing protocols applied on each router works to compute the forwarding table of each router in a distributed fashion. Correspondingly each router makes an independent forwarding decision. A well-known and widely used routing protocol for routing within an administrative domain (or Autonomous System, AS) is Open Shortest Path First (OSPF) [2]. During the routing process, each router determines what packets should be forwarded over which interface. This decision is then recorded in the forwarding table of the router [2]. Due to this process, conventional IP routing without Multiprotocol Label Switching (MPLS) enabled requires (i) all routers require routing protocol with full routing information, (ii) routers only able to make a destination-based forwarding decision and (iii) routers need to make a routing look-up for every single hop; which are the drawback of the non-MPLS network [1].

By enabling MPLS, conventional IP routing is combined with a label swapping technique, implemented by separate control and forwarding component [1]. MPLS is a promising effort in order to deliver (i) the traffic management and Quality of Service (QoS), and (ii) better speed in the packet-forwarding process while retaining the flexibility of an IP-based network approach [1, 2], which enhance router performance even more. MPLS provides more than destination based routing. One way of using MPLS is to put the routing information onto a router. This information is not changed until the next operator action. This means that a router does not make any independent forwarding decision. MPLS provides more influence on the routing to the operator. The operator is absolutely free when setting up these MPLS tunnels. He may route traffic over routes which OSPF had never taken. Because MPLS [19] is a rather new technology which is currently deployed in the ISPs backbones, some research has also be done on this topic. Mikkel Thorup and David Applegate [20] show, that with MPLS it is possible to find a load optimal routing. Sprint publishes [21] its own considerations about the deployment of MPLS while others [22,23,24] answer questions about the applicability and the deployment of MPLS.